

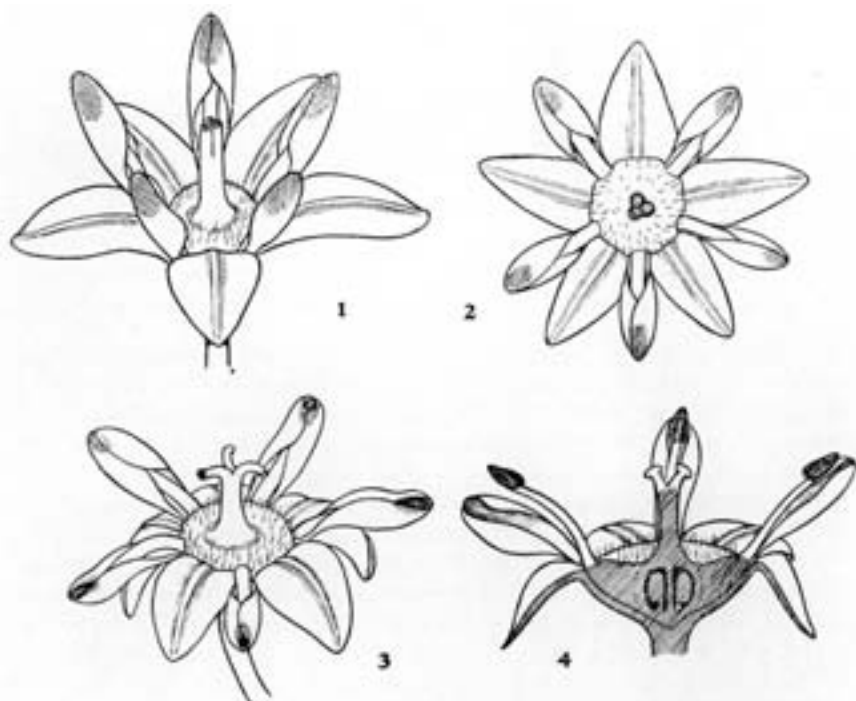
The Raisin Tree - Its Use, Hardiness and Size

by GARY L. KOLLER and JOHN H. ALEXANDER III

Interest in unusual plants that produce edible parts seems to be on the increase. One such plant, almost totally unrecognized in Western literature, is the raisin tree (*Hovenia dulcis*) which in Chinese is known as Chih-chü. This Rhamnaceous plant derives its common English name from the enlarged and irregular flowers stalks that have been sold as fruits in the Peoples Republic of China since pre-Confucian times. These stalks are small and inconspicuous but they rapidly increase in size as the fruit matures. With maturation, and after frost, the pedicle color changes to russet and the interior of the stalk is filled with a yellowish pear-flavored pulp. Individually, the stalks are small, but abundant production compensates to produce bulk and this results in a crop that requires labor-intensive harvest techniques. The enlarged pedicle is unusual in that it is not part of the fruit structure but is entirely distinct and subtends the pendent terminal fruits. The ripe fruits are small, dry, rounded, three-celled capsules about the size of a pea. Each contains three flat, shiny black to orange-brown seeds. In China these seeds are sold under the name of Chih-chü-tzū.

From what these authors have been able to ascertain from the literature and through discussion with Dr. S. L. Hu, a Chinese botanist, the ripe pedicles are collected from the wild by small school children instead of being cultivated in orchards as a crop. If cultivars have been selected in the Orient, they are unknown to us. Perhaps commercial interest could be enhanced by the selection of plants with larger pedicles, higher sugar content, greater productivity or more reliable annual fruit production.

G. A. Stuart in *Chinese Materia Medica* says: "Both the fruits and the fleshy peduncles are considered to be antifebrile, laxative, diuretic and quieting to the stomach. Remarkable antivinous properties also are attributed to them. It is said that after the ingestion of large quantities of alcohol the use of this drug will prevent any intoxication or poisonous action. The bark of the tree is used in diseases of the rectum." K. C. Chang in *Food in Chinese Culture* states that hovenia is sometimes styled 'tree honey' in Chinese for the sweet extract of the seeds, bough and young leaves is a common substitute for bee honey.





This 53-year-old raisin tree (A.A. 19571) is the Arnold Arboretum's best specimen with a height of 35 feet and a spread of 22 feet. Photo: E. Gray.

H. F. Chow in *The Familiar Trees of Hopei* indicates that this is a valuable commercial species. In addition to food and medicinal use, its wood is hard and heavy, and is used for manufacturing furniture, etc.

As a wild population, this plant finds its native home in China, Korea and Japan, where it occurs in the warmer portions of these countries. In Japan it occurs on the Okushiri Island of Hokkaido as well as on the islands of Honshu, Shikoku and Kyushu. In China it is found in provinces of Hopei, Honan, Shantung, Chekiang, Hupeh, Hunan, Szechuan, Yunnan, Kweichow, Kwangtung and Fukien. Through cultivation the plant was introduced very early into India.

Left above: Flower of Hovenia dulcis, from The Botanical Magazine of Tokyo, vol. 53, no. 635, 1939.

Below: Hovenia dulcis, from The American Garden, vol. 12, 1891.

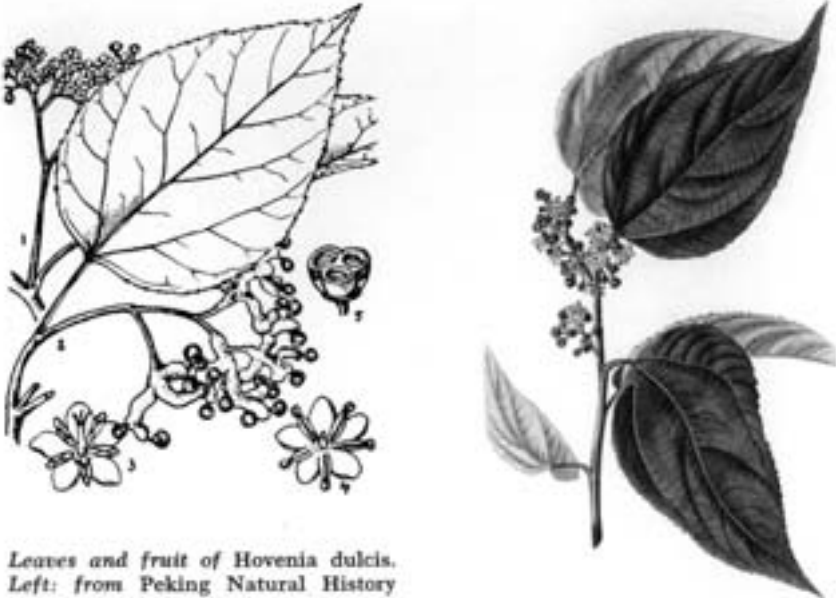
The Chinese literature lists *Hovenia dulcis* as growing to 30 feet with an equal spread. It is said to occur in shady glens in moist situations where it forms extensive thickets, and occasionally in the mountains as a secondary plant that occurs at altitudes ranging from 500 to 4,000 feet.

While this species was introduced into cultivation in the west in 1820, it remains little known even in many botanical collections. At the Arnold Arboretum two large trees are alive and thriving as of December 1978. The best specimen (A.A. 19571) was obtained as seed on December 24, 1924 from the Botanic Garden in Washington, D.C. When planted out in 1931, the tree was placed in an exposure of full sun on a southeast facing slope which is one of our warmest microclimates. In December 1978 at fifty-three years of age, this tree is approximately 35 feet tall with a spread of 22 feet. A single trunk divides at approximately 12 inches above the soil line into two major stems. The largest branch has a D.B.H. of 1 foot 1 inch, and the lesser a D.B.H. of 11 1/2 inches. The tree has a rounded head, strong u-shaped crotches, deep roots and no visible sign of die-back or breakage from ice and snow. Average stem growth was 12 inches for current year's wood. The 1978 growing season produced an abundant crop of seeds.

The second plant (A.A. 87-33) was collected on January 18, 1933 by W. H. Judd as seed from the Botanic Garden in Washington, D.C. It is interesting to note that the two surviving trees at the Arnold Arboretum both originated from the same seed source. This tree was permanently planted in 1937 near the first plant described, but instead of having an exposure of full sun, the plant is shaded and stretches for light. At forty-five years of age, this tree is approximately 30 feet tall but its spread has been greatly distorted by competition from neighboring plants. The D.B.H. of the single stem is 10 1/2 inches. No fruiting is evident for the 1978 season.

The earliest accessions of this plant at the Arnold Arboretum were in 1880 when seeds were received from the Agricultural College in Sapporo, Japan, and a plant was sent from S. B. Parsons and Sons, a nursery in Flushing, New York. None of these plants survives but the early records do not indicate the reason for failure.

Three specimens exist in December 1978 at the Morris Arboretum in Philadelphia, Pennsylvania. One is a towering giant (M459) with a height of 78 feet and spread of 68 feet. This tree has an interesting history as related by Joseph Adams of the Arboretum staff. When he started work at the Morris in February 1933, the tree was already a large specimen of at least 30 feet in height, but the records lacked a source or age for the plant. The winter of 1933-34 was devastating with gusting winds and a record of -17°F . The tree froze back to within a few feet of the ground. However, it recovered by sending out vigorous shoots from the main trunk and in 1942 after eight growing seasons, attained a height of 31 feet and a spread



Leaves and fruit of *Hovenia dulcis*.
Left: from Peking Natural History
Bulletin, 1934. Right: from Botanical
Magazine, vol. 50, 1824.

of 35 feet. So its present height of 78 feet was achieved with the backing of a strong, well-established root system, in only forty-five years. This tree has two trunks that divide from a single stem at approximately 1 foot above the soil line. The east trunk has a D.B.H. of 2 feet 4 inches and the west trunk a D.B.H. of 2 feet. Mr. Adams only can remember the tree fruiting twice, with the last time being approximately 1975.

As with many living things, this tree was struck by tragedy. Approximately a year and a half ago, lightning hit the plant causing major bark fissures, thinning of the canopy and loss of vigor. Despite this, the tree survived the stresses of an unusually cold winter in the 1977-78 season. This is perhaps the largest specimen existing in North America and larger than any mentioned in the literature reviewed by these authors.

The Morris Arboretum also has two lesser specimens. One (52-66-A) is 40 feet tall with a spread of 34 feet. It produced an abundant crop of seeds in 1978. The other (57-226) came to the Morris as a B & B specimen from the Taylor Arboretum in 1957. Today this plant is 45 feet tall, spreads 30 feet and rises as a single stem with a D.B.H. of 11 inches to the height of 8 or 10 feet before branching.

Documentation of cold hardiness has been limited, but Allen Cook,



The bark of hovenia is light gray with occasional exfoliated layers revealing colors of warm, reddish-brown. Photo: E. Gray.

horticulturist at the Dawes Arboretum in Newark, Ohio offers the following observations: Seeds were received from Highland Park in Rochester, New York in 1967. They were stratified at 40°F for forty days and two known plants resulted. After attaining some size in a nursery area, the plants were put into permanent locations in June of 1975. The sites selected were protected from winds, with a north

or northwest exposure and good drainage. The winter of 1975-76 was severe with temperatures to -10°F ; both of the newly transplanted plants froze to the ground. However, in spring 1976, both sprouted from the root system and by the end of the growing season one was 3 feet tall and the other 5 feet tall. Nature provided a tougher test the following winter with low temperatures of -23°F , and both trees died.

While one could never describe *hovenia* as outstanding from an ornamental perspective, it does have several notable features. The broadly ovate leaves are a glossy dark green and remain remarkably free of insects and disease. At the Arnold Arboretum during the summer of 1978 the largest plant produced many flowered, terminal cymes of pale creamy-white flowers in mid- to late July, followed by fruit clusters that ripened in October. Gray bark with narrow but deep fissures in the vertical plane gives a series of rectangular plates which occasionally exfoliate and reveal delightful contrasting colors of reddish-brown. Viewed from some distance, the smaller branches are not straight as an arrow, but undulate in long waves giving the branch structure a visually fuller appearance.

From the observations of these authors, the tree appears to grow best in full sun and it seems to be pH adaptable and thrive in a wide range of soil types.

Propagation experiments were performed in 1963 at the Arnold Arboretum to determine the best method of germinating the seeds. Five lots of two hundred seeds were treated. Lot 1 was sown with no pretreatment. Seeds of lot 2 were cold stratified for three months at 40°F before sowing. Lot 3 was stratified at fluctuating greenhouse temperatures of from 45°F - 80°F for three months, followed by three months of cold stratification. Seeds of lot 4 were scarified in concentrated sulfuric acid for one hour prior to sowing; lot 5 received the one hour of acid treatment plus three months of cold stratification.

The two lots of acid treated seeds gave the best results with germination percentages of slightly better than 40 percent while the highest percentage from lots 1-3 was the 3 percent achieved by lot 1. These results indicate that germination is inhibited by a hard, impermeable seed coat, and imbibition of water and germination cannot occur until the seed coat becomes permeable. This would occur in the soil over a long period of time while the seed coats were slowly degraded by natural forces. Scarification by acid treatment or by mechanical means such as filing or sandpapering hastens seed coat degradation and permeability, thereby allowing germination.

Later experiments at the Arnold Arboretum with acid scarification of *hovenia* seeds have been performed with acid treatment of 1 1/2, 2 and 2 1/2 hours. General germination occurred at both the 2 and 2 1/2 hour treatments with the 2 1/2 hour treatment appearing slightly better.



Hovenia dulcis growing in Yunyang Hsien, Eastern Szechuan, China, at an altitude of 3,000 feet. The tree is 70 feet tall with a circumference of 6 feet. Photographed by E. H. Wilson on July 3, 1910.

In researching this article, the authors found several references stating that cuttings of ripe wood could be rooted, but no literature to substantiate this could be found. The Arnold Arboretum records show that cuttings were taken in March 14, 1929 and that at least one of the cuttings rooted, for it was planted out on the grounds in 1933. Experiments to determine the best method of asexual propagation are now underway at the Dana Greenhouses.

In order to promote further testing of this plant, we have gathered a large quantity of seeds from our older plant. These seeds will be available to members only on a first-come-first-served basis until May, 1979. In requesting seeds, please enclose a self-addressed, stamped envelope and address the request to:

Hovenia Seeds
The Arnold Arboretum
The Arborway
Jamaica Plain, MA 02130

Because the available literature on this plant is sparse, it would be interesting to hear from others who have grown or observed the raisin tree. Additional firsthand comments will help us document the use, cold hardiness and ultimate size of *Hovenia dulcis*.

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